

WHAT IS CLAIMED IS:

1. An image reading apparatus comprising:
  - a document feeder adapted to convey an original;
  - an image sensor adapted to read the original
- 5 conveyed to a platen by said document feeder;
  - a memory adapted to store image data for each pixel;
  - a controller adapted to control said image sensor to execute reading at a predetermined position a
- 10 plurality of number of times without placing any original on the platen while driving an original convey member of said document feeder;
  - a comparator adapted to compare image data of the original output from said image sensor with image data of a corresponding pixel, which is stored in said memory, every time the original convey member is read, and update the image data stored in said memory to data having a larger value; and
- 15 a detector adapted to detect a presence/absence and position of dust and/or dirt on the platen on the basis of the number of times of reading the original convey member and the image data stored in said memory after the end of a plurality of number of times of reading the original convey member.
- 20 2. The apparatus according to claim 1 further comprising a resolution converter adapted to reduce a resolution of the image data output from said image
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sensor,

wherein said memory has a capacity corresponding to the number of pixels of one line of the image data whose resolution is reduced by said resolution

5 converter, and

said comparator compares the image data having the reduced resolution with the image data of the corresponding pixel, which is stored in said memory.

3. The apparatus according to claim 2, wherein  
10 said resolution converter outputs a smallest image data value for every plural number of pixels adjacent to each other.

4. The apparatus according to claim 1 further comprising a grayscale converter adapted to reduce a  
15 grayscale level of the image data output from said image sensor,

wherein said memory has a capacity corresponding to the number of pixels of one line of the image data whose grayscale level is reduced by said grayscale  
20 converter, and

said comparator compares the image data having the reduced grayscale level with the image data of the corresponding pixel, which is stored in said memory.

5. The apparatus according to claim 1, wherein  
25 when dust or dirt is detected by said detector, said controller moves a position of said image sensor.

6. The apparatus according to claim 1, wherein

the apparatus has a first reading mode in which a position of said image sensor is fixed, and the original is read while being conveyed by said document feeder and a second reading mode in which the original  
5 is stationarily held on the platen and read while moving said image sensor, and

when the dust or dirt is detected by said detector, said controller moves said image sensor to one of a plurality of predetermined positions, and when  
10 the dust or dirt is detected by said detector at all of the plurality of positions, said controller inhibits the first reading mode and sets the second reading mode.

7. The apparatus according to claim 6 further comprising a notification unit adapted to notify a user  
15 of inhibition of the first reading mode.

8. The apparatus according to claim 6, wherein said controller permits the first reading mode in accordance with removal of the dust or dirt on the platen.

20 9. The apparatus according to claim 1 further comprising an image processing unit adapted to replace pixel data corresponding to a position of the detected dust or dirt with pixel data of a pixel position adjacent to the position of the dust or dirt.

25 10. The apparatus according to claim 1 further comprising an image processing unit adapted to replace pixel data corresponding to a position of the detected

dust or dirt with pixel data input for an immediately preceding pixel.

11. An image reading apparatus comprising:
  - a document feeder adapted to convey an original;
  - 5 an image sensor adapted to read the original conveyed to a platen by said document feeder;
  - a controller adapted to control said image sensor to execute reading at a predetermined position a plurality of number of times without placing any original on the platen while driving an original convey member of said document feeder;
  - 10 an adder adapted to add for each pixel image data of the original convey member read the plurality of number of times;
  - 15 a memory adapted to store for each pixel the image data added by said adder;
  - a determination unit adapted to determine a threshold value on the basis of the number of times of reading the original convey member and the image data stored in said memory; and
  - 20 a detector adapted to detect a presence/absence and position of dust and/or dirt on the platen on the basis of the threshold value and image data output from said image sensor without placing any original on the platen.

12. The apparatus according to claim 11, wherein when the image data has a value smaller than

the threshold value, said detector determines that the dust or dirt is present.

13. The apparatus according to claim 11,  
wherein said determination unit determines the  
5 threshold value by subtracting a predetermined value  
from the image data stored in said memory.

14. The apparatus according to claim 11,  
wherein when the image data value stored in said memory  
is less than a specific value, said determination unit  
10 sets the threshold value to a predetermined value.

15. The apparatus according to claim 11 further  
comprising a resolution converter adapted to reduce a  
resolution of the image data output from said image  
sensor,

15 wherein said adder adds the image data whose  
resolution is reduced by said resolution converter, and  
said memory has a capacity corresponding to the  
number of pixels of one line of the image data having  
the reduced resolution.

20 16. The apparatus according to claim 11 further  
comprising a grayscale converter adapted to reduce a  
grayscale level of the image data output from said  
image sensor,

25 wherein said adder adds the image data whose  
grayscale level is reduced by said grayscale converter,  
and

said memory has a capacity corresponding to the

number of pixels of one line of the image data having the reduced grayscale level.

17. The apparatus according to claim 11, wherein when the dust or dirt is detected by said 5 detector, said controller moves a position of said image sensor.

18. The apparatus according to claim 11, wherein the apparatus has a first reading mode in which 10 a position of said image sensor is fixed, and the original is read while being conveying by said document feeder and a second reading mode in which the original is stationarily held on the platen and read while moving said image sensor, and

when the dust or dirt is detected by said 15 detector, said controller moves said image sensor to one of a plurality of predetermined positions, and when the dust or dirt is detected by said detector at all of the plurality of positions, said controller inhibits the first reading mode and sets the second reading mode.

20. 19. The apparatus according to claim 18 further comprising a notification section adapted to notify a user of inhibition of the first reading mode.

20. The apparatus according to claim 18, wherein said controller permits the first reading mode 25 in accordance with removal of the dust or dirt on the platen.

21. The apparatus according to claim 11 further

comprising an image processing unit adapted to replace pixel data corresponding to a position of the detected dust or dirt with pixel data of a pixel position adjacent to the position of the dust or dirt.

5        22. The apparatus according to claim 11 further comprising an image processing unit adapted to replace pixel data corresponding to a position of the detected dust or dirt with pixel data input for an immediately preceding pixel.

10        23. A dust detection method in an image reading apparatus having a document feeder adapted to convey an original, an image sensor adapted to read the original conveyed to a platen by the document feeder, and a memory adapted to store image data for each pixel,

15        comprising:

              controlling the image sensor to execute reading at a predetermined position a plurality of number of times without placing any original on the platen while driving an original convey member of the document

20        feeder;

              comparing image data of the original output from the image sensor with image data of a corresponding pixel, which is stored in the memory, every time the original convey member is read;

25        updating the image data stored in the memory to data having a larger value on the basis of a comparison result; and

detecting a presence/absence and position of dust  
and/or dirt on the platen on the basis of the number of  
times of reading the original convey member and the  
image data stored in the memory after the end of a  
5 plurality of number of times of reading the original  
convey member.

24. The method according to claim 23 further  
comprising:

reducing a resolution of the image data output  
10 from the image sensor,

wherein the memory has a capacity corresponding  
to the number of pixels of one line of the image data  
whose resolution is reduced, and

15 upon comparing image data output from the image  
sensor with image data stored in the memory, the image  
data having the reduced resolution is compared with the  
image data of the corresponding pixel, which is stored  
in the memory.

25. The method according to claim 24, wherein  
upon converting the resolution, a smallest image data  
value for every plural number of pixels adjacent to  
each other is output.

26. The method according to claim 23 further  
comprising:

25 reducing a grayscale level of the image data  
output from the image sensor,

wherein the memory has a capacity corresponding

to the number of pixels of one line of the image data whose grayscale level is reduced, and

upon comparing image data output from the image sensor with image data stored in the memory, the image  
5 data having the reduced grayscale level is compared with the image data of the corresponding pixel, which is stored in the memory.

27. A control method for the image reading apparatus which executes the dust detection method of  
10 claim 23, wherein when the dust or dirt is detected, a position of the image sensor is moved, and the dust detection method is repeatedly executed.

28. A control method for the image reading apparatus which executes the dust detection method of  
15 claim 23, wherein

the image reading apparatus has a first reading mode in which a position of the image sensor is fixed, and the original is read while being conveyed by the document feeder and a second reading mode in which the  
20 original is stationarily held on the platen and read while moving the image sensor, and

the method comprises:

moving the image sensor to one of a plurality of predetermined positions when the dust or dirt is  
25 detected, and repeatedly executing the dust detection method, and

inhibiting the first reading mode and setting the

second reading mode when the dust or dirt is detected at all of the plurality of positions.

29. The method according to claim 28, characterized by further comprising notifying a user of  
5 inhibition of the first reading mode.

30. The method according to claim 28, characterized by further comprising permitting the first reading mode in accordance with removal of the dust or dirt of the platen.

10 31. An image processing method in the image reading apparatus which executes the dust detection method of claim 23, comprising replacing pixel data corresponding to a position of the detected dust or dirt with pixel data of a pixel position adjacent to  
15 the position of the dust or dirt.

32. An image processing method in the image reading apparatus which executes the dust detection method of claim 23, comprising replacing pixel data corresponding to a position of the detected dust or  
20 dirt with pixel data input for an immediately preceding pixel.

33. A dust detection method in an image reading apparatus having a document feeder adapted to convey an original, and an image sensor adapted to read the  
25 original conveyed to a platen by the document feeder, comprising:

controlling the image sensor to execute reading

at a predetermined position a plurality of number of times without placing any original on the platen while driving an original convey member of the document feeder;

5        adding for each pixel image data of the original convey member read the plurality of number of times;  
            storing for each pixel the added image data in a memory;

10      determining a threshold value on the basis of the number of times of reading the original convey member and the image data stored in the memory; and

15      detecting a presence/absence and position of dust and/or dirt on the platen on the basis of the threshold value and image data output from the image sensor without placing any original on the platen.

34.     The method according to claim 33, wherein upon detecting the presence/absence and position of dust and/or dirt, when the image data has a value smaller than the threshold value, it is determined that  
20      the dust or dirt is present.

35.     The method according to claim 33, wherein the threshold value is determined by subtracting a predetermined value from the image data stored in the memory.

25      36.    The method according to claim 33, wherein when the image data value stored in the memory is less than a specific value, the threshold value is set to a

predetermined value.

37. The method according to claim 33 further comprising reducing a resolution of the image data output from the image sensor,

5 wherein upon adding the image data, the image data having the reduced resolution is added, and

the memory has a capacity corresponding to the number of pixels of one line of the image data having the reduced resolution.

10 38. The method according to claim 33 further comprising reducing a grayscale level of the image data output from the image sensor,

wherein upon adding the image data, the image data having the reduced grayscale level is added, and

15 the memory has a capacity corresponding to the number of pixels of one line of the image data having the reduced grayscale level.

39. A control method for the image reading apparatus which executes the dust detection method of  
20 claim 33, wherein when the dust or dirt is detected, a position of the image sensor is moved, and the dust detection method is repeatedly executed.

40. A control method for the image reading apparatus which executes the dust detection method of  
25 claim 33, wherein

the image reading apparatus has a first reading mode in which a position of the image sensor is fixed,

and the original is read while being conveyed by the document feeder and a second reading mode in which the original is stationarily held on the platen and read while moving the image sensor, and

5       the method comprises:

      moving the image sensor to one of a plurality of predetermined positions when the dust or dirt is detected, and repeatedly executing the dust detection method, and

10      inhibiting the first reading mode and setting the second reading mode when the dust or dirt is detected at all of the plurality of positions.

41.     The method according to claim 40,  
characterized by further comprising notifying a user of  
15 inhibition of the first reading mode.

42.     The method according to claim 40,  
characterized by further comprising permitting the  
first reading mode in accordance with removal of the  
dust or dirt of the platen.

20      43.    An image processing method in the image  
reading apparatus which executes the dust detection  
method of claim 33, comprising replacing pixel data  
corresponding to a position of the detected dust or  
dirt with pixel data of a pixel position adjacent to  
25 the position of the dust or dirt.

44.     An image processing method in the image  
reading apparatus which executes the dust detection

method of claim 33, comprising replacing pixel data corresponding to a position of the detected dust or dirt with pixel data input for an immediately preceding pixel.

5        45. A computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for a dust detection method in an image reading apparatus having a document feeder adapted to convey an original, an image sensor  
10      adapted to read the original conveyed to a platen by the document feeder, and a memory adapted to store image data for each pixel, said product including:

15      first computer readable program code means for controlling the image sensor to execute reading at a predetermined position a plurality of number of times without placing any original on the platen while driving an original convey member of the document feeder;

20      second computer readable program code means for comparing image data of the original output from the image sensor with image data of a corresponding pixel, which is stored in the memory, every time the original convey member is read;

25      third computer readable program code means for updating the image data stored in the memory to data having a larger value on the basis of a comparison result; and

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fourth computer readable program code means for  
detecting a presence/absence and position of dust  
and/or dirt on the platen on the basis of the number of  
times of reading the original convey member and the  
5 image data stored in the memory after the end of a  
plurality of number of times of reading the original  
convey member.

46. A computer program product comprising a  
computer usable medium having computer readable program  
10 code means embodied in said medium for a control method  
for the image reading apparatus which executes the dust  
detection method of claim 23, said product including:

first computer readable program code means for  
moving a position of the image sensor when the dust or  
15 dirt is detected; and

second computer readable program code means for  
repeatedly executing the dust detection method.

47. A computer program product comprising a  
computer usable medium having computer readable program  
20 code means embodied in said medium for a control method  
for the image reading apparatus which executes the dust  
detection method of claim 23, wherein the image reading  
apparatus has a first reading mode in which a position  
of the image sensor is fixed, and the original is read  
25 while being conveyed by the document feeder and a  
second reading mode in which the original is  
stationarily held on the platen and read while moving

the image sensor, said product including:

first computer readable program code means for  
moving the image sensor to one of a plurality of  
predetermined positions when the dust or dirt is  
5 detected, and repeatedly executing the dust detection  
method, and

second computer readable program code means for  
inhibiting the first reading mode and setting the  
second reading mode when the dust or dirt is detected  
10 at all of the plurality of positions.

48. A computer program product comprising a  
computer usable medium having computer readable program  
code means embodied in said medium for an image  
processing method in the image reading apparatus which  
15 executes the dust detection method of claim 23, said  
product including:

computer readable program code means for  
replacing pixel data corresponding to a position of the  
detected dust or dirt with pixel data of a pixel  
20 position adjacent to the position of the dust or dirt.

49. A computer program product comprising a  
computer usable medium having computer readable program  
code means embodied in said medium for an image  
processing method in the image reading apparatus which  
25 executes the dust detection method of claim 23, said  
product including:

computer readable program code means for

replacing pixel data corresponding to a position of the detected dust or dirt with pixel data input for an immediately preceding pixel.

50. A computer program product comprising a  
5 computer usable medium having computer readable program code means embodied in said medium for a dust detection method in an image reading apparatus having a document feeder adapted to convey an original, and an image sensor adapted to read the original conveyed to a platen by the document feeder, said product including:

first computer readable program code means for controlling the image sensor to execute reading at a predetermined position a plurality of number of times without placing any original on the platen while  
15 driving an original convey member of the document feeder;

second computer readable program code means for adding for each pixel image data of the original convey member read the plurality of number of times;

20 third computer readable program code means for storing for each pixel the added image data in a memory;

fourth computer readable program code means for determining a threshold value on the basis of the  
25 number of times of reading the original convey member and the image data stored in the memory; and

fifth computer readable program code means for

detecting a presence/absence and position of dust and/or dirt on the platen on the basis of the threshold value and image data output from the image sensor without placing any original on the platen.

5        51. A computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for a control method for the image reading apparatus which executes the dust detection method of claim 33, said product including:

10        first computer readable program code means for moving a position of the image sensor when the dust or dirt is detected; and

            second computer readable program code means for repeating the dust detection method.

15        52. A computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for a control method for the image reading apparatus which executes the dust detection method of claim 33, wherein the image reading apparatus has a first reading mode in which a position of the image sensor is fixed, and the original is read while being conveyed by the document feeder and a second reading mode in which the original is stationarily held on the platen and read while moving  
20        the image sensor, said product including:

            first computer readable program code means for moving the image sensor to one of a plurality of

predetermined positions when the dust or dirt is detected, and repeatedly executing the dust detection method, and

second computer readable program code means for  
5 inhibiting the first reading mode and setting the second reading mode when the dust or dirt is detected at all of the plurality of positions.

53. A computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for an image processing method in the image reading apparatus which executes the dust detection method of claim 33, said product including:

computer readable program code means for  
15 replacing pixel data corresponding to a position of the detected dust or dirt with pixel data of a pixel position adjacent to the position of the dust or dirt.

54. A computer program product comprising a computer usable medium having computer readable program code means embodied in said medium for an image processing method in the image reading apparatus which executes the dust detection method of claim 33, said product including:

computer readable program code means for  
25 replacing pixel data corresponding to a position of the detected dust or dirt with pixel data input for an immediately preceding pixel.